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OFFICE OF THE ASSISTANT SECRETARY
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NCADINST 4451.1A
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NCAD INSTRUCTION 4451.1A

From: Director, Naval Cost Analysis Division (NCAD/FMB-6)

Subj: DOCUMENTATION GUIDE

Encl: (1) NCAD Guide for the Documentation of Independent Cost Estimates (ICEs)

1. Cancellation. Effective immediately, NCAD instruction 4451.1 is cancelled.

2. Purpose. Promulgate the NCAD Documentation Guide 4451.1A as enclosure (1). The procedures and requirements delineated in NCADINST 4451.1A are to be followed for documenting NCAD cost estimates.

3. Applicability.

a. NCAD analysts, including support contractors, will follow the enclosed guidance to document their analyses.

b. Copies of the NCAD documentation of ICEs should be provided to the program manager, AIR-4.2, SEA-017, OSD(PA&E), ASN(RD&A), DASN(Space and C4I), as appropriate. ICE documentation should not be provided to other organizations unless specifically authorized by NCAD.

4. Revisions. Proposals for revisions or changes may be recommended through the chain of command to the Director, Naval Cost Analysis Division (NCAD).

5. Action. Enclosure (1) assigns documentation responsibilities within NCAD. All NCAD personnel, and their support contractors, shall comply with the guidance therein.

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Distribution:
OASN(FM&C)
OASN(FMB)
All NCAD Staff Members

NCAD GUIDE FOR THE DOCUMENTATION OF COST ESTIMATES

1. General Criteria for Documentation. The primary principles to keep in mind are:

a. Documentation should describe the cost estimating process, data sources, and methodologies in such a way that a cost analyst unfamiliar with the program could understand what had been done and replicate the estimates.

b. Results should be presented in formats that are useful for preparing reports and correspondence for higher authority.

2. Purposes of Documentation. The following are some of the purposes of documentation:

a. To fulfill NCAD and SECNAV requirements.

b. To define the scope of the analysis and permit future replication.

c. To provide a direct track between NCAD's estimate and externally reported results.

d. To provide a record, explanation and justification of the cost estimating methodologies employed.

e. To produce a document that will be useful as a guide in conducting future estimates/assessments and for training of NCAD personnel.

f. To allow persons not familiar with the program or the estimating methodology to determine what was done.

g. To be able to respond to audits in later years.

h. To be able to track NCAD estimates over the life of a program.

i. To enhance cost estimating databases.

3. Scope. Evaluation of past documentation indicates that three general areas should be emphasized to produce a well-documented estimate: overall structure, specific content, and format.

3-1. Overall Structure

a. General. The final documentation package should contain an explanation of the estimate and a copy of all relevant reports and correspondence that ensued from the estimating effort. For example, copies of presentations to the Technical Review Board (TRB), memorandum to the NPDM principals, and the Navy CAIG presentation should be placed in appendices or tabs. Documentation should contain a complete record of all major events in the estimating process, including NCAD's participation and correspondence that was relevant to the Milestone decision for which the estimate was conducted.

b. Hierarchy of Information. Documentation should be laid out so that it goes from the general to the specific. General information should be placed in the main body of the report and detailed information should go into supporting appendices or tabs. Documentation should be laid out so that it affords flexibility, i.e., various sections can be expanded upon or new sections added without disruption to previous work.

c. Layout. Since an estimate is generally required to address a complete life cycle cost (LCC), the basic approach for conducting and documenting any estimate should be by phase of the life cycle. If a Cost Analysis Requirements Description (CARD) is used as the basis for estimating the cost of each phase, specific reference should be made to the CARD. Each phase should contain the cost estimating assumptions for that phase, the estimate and supporting analyses, pertinent comments and conclusions. To this end, it is suggested that the basic layout consist of:

(1) An executive summary.

(2) An introductory section, which gives a brief general description of methodology and cost estimating assumptions.

(3) A LCC section.

(4) Separate sections for the development, procurement and O&S phases (for weapons systems); and investment, O&S, and alternative phase-out (for automated information systems, (AISs)).

(5) A section that address benefits (for AISs only)

(6) A section that addresses uncertainty.

(7) A section that addresses risk and sensitivity.

(8) A section that addresses any throughputs used in the estimate.

(9) Supporting appendices, tabs or attachments as needed.

3-2. Specific Content

a. An Executive Summary. This should be the first item in the report following the cover sheet. It should consist of no more than two pages (preferably only one) and include the following:

(1) An explanation of why the estimate was being conducted and a very brief status of the program.

(2) A specific statement as to what action the milestone decision would authorize the PM to take (e.g., procurement of 10 Low Rate Initial Production Units (LRIP) in FY04 with an option of 12 more in FY05).

(3) An explanation of how comprehensive the NCAD estimate is. Normally this will be a complete LCC, but if for some reason a phase, such as O&S, was not estimated, this should be stated and a reason given. Also, if a phase, such as development or investment, has been completed, it should be stated that actual costs, rather than an estimate, were used for that phase.

(4) Conclusions and issues.

b. An Introductory Section. This section should set the stage for the entire documentation, giving a "big picture" of the methodology.

(1) This section should address in detail any major issues raised by the estimate. For example, issues of ACAT designation, adequacy of the baseline or the comprehensiveness of the estimate are properly addressed here.

(2) A lot of analytic detail is not desirable in this section. Do not get into first unit costs, learning curves, rate effects or any specific numbers in this section. This information should be contained in other, more detailed sections.

(3) The introductory section should provide:

(a) A description of the basic methodology employed for each phase of the life cycle. For example, development might be a sunk cost, procurement based on extrapolation from prototype actuals, and O&S based on VAMOSC. For an AIS program, software development might be based on a count of function points or objects, O&S based on a count of users, and phase-out based on historical averages. A combination of methods for each phase may be appropriate.

(b) Background information on the program.

(c) A description of the acquisition strategy being pursued by the PM.

(d) Details of the decision expected at the Milestone, and any follow-up actions such as exit criteria.

(e) Definition in general terms of the programmatic and technical baselines. That is, state the cost estimating assumptions bounding the estimate, what's included and what's not included. Reference should be made to the CARD. It should be specifically stated that the estimate contains cost estimates for the baseline delineated in the CARD.

(f) A brief description of methodology for each phase, stating that details will be provided in individual sections of the report devoted to those phases.

c. Development Phase (weapons systems); Investment Phase (AISs). This section should provide a Work Breakdown Structure (WBS) or Cost Element Structure (CES) that includes a definition of each element and how it was estimated. Any weaknesses in data or methodology used in the estimate should be identified. Also, any important issues relating to schedule, technical risks or baseline assumptions should be discussed. This information should be as specific as possible because it can highlight areas for future research.

(1) Details of the software development estimate, first unit cost for EMD hardware, learning curves, CERs, support factors, etc., and their associated statistics should be included in this section.

(2) The development or investment estimate should be displayed by WBS or CES element.

(3) Massive, complex workbooks should be relegated to appendices, tabs or attachments.

(4) There should be a display that clearly tracks to the development or investment cost estimates contained in the NPDM principals' memorandum.

d. Procurement Phase (for weapons systems only). This should be similar to the development phase section, giving a WBS, definition of elements, and description of how each element was estimated. Any weaknesses in data or methodology used in the procurement estimate should be identified. This information should be as specific as possible, because it can highlight areas for future research.

(1) Acquisition strategy for the procurement phase should be discussed.

(2) Details of first unit costs for production hardware, learning curves, CERs, support factors, step-down factors, etc., and their associated statistics should be included in this section.

(3) The procurement estimate should be displayed by WBS element.

(4) Massive, complex workbooks should be relegated to appendices, tabs or attachments.

(5) There should be a display which clearly tracks to the procurement cost estimates contained in the NPDM principals' memorandum.

e. O&S Phase. Not all estimates will include an O&S phase, but when there is one its documentation should be similar to documentation for the other phases. That is, define all cost elements and provide a description of how each element was estimated. Any weaknesses in data or methodology used in the O&S estimate should be identified. This information should be as specific as possible because it can highlight areas for future research.

(1) The number of years in the O&S phase should be specified, along with an explanation of whether a phase-in, phase-out approach, or some other approach, was used in estimating O&S costs.

(2) Details of data extraction from VAMOSC, or other databases used for estimating O&S elements, should be included in this section.

(3) Since cost estimating by analogy is frequently used in the O&S phase, an explanation of the details of the analogy and how they apply to the new system should be included.

(4) The source of factors and rates used in estimating O&S elements and their associated statistics must be included.

(5) Additionally, the O&S section should identify all out-of-the-ordinary adjustments made to VAMOSC or other data sources. Examples might include: use of a factor to adjust for retirement; adjustment of O&S data by average unit cost (AUC) or weight; use of steaming hours to factor costs up or down.

(6) Particular systems may involve O&S elements not used in other systems, or some elements may not be relevant. An explanation should be made of these special circumstances. Again, this would be useful for future research.

(7) The O&S estimate should be displayed by WBS element.

(8) There should be a display which clearly tracks to the O&S cost estimates contained in the NPDM principals' memorandum.

f. Alternative Phase Out Section (for AISs only). Like sections for the other phases, list and define all CES elements and explain how they were estimated.

(1) There should be a display which clearly tracks to the phase-out cost estimates contained in the NPDM principals' memorandum.

g. Life Cycle Cost (LCC) Section. After estimates for all three phases of the life cycle have been made, there should be a section that summarizes and displays the entire LCC, and that compares it to the Program Office estimate. Cost deltas should be briefly explained. This section does not need to be extensive in size, and it need not have any detail about methodology, since that is covered in the individual sections for each phase. The displays contained in this section may be duplicative of the top-level displays from each of the three life cycle phases.

h. Benefits Analysis Section. This section, for AIS programs only, should assess the accuracy of quantitative and non-quantitative benefits as defined in the program baseline.

i. Affordability Section. This section should address the affordability of the system by comparing program-office and independent cost estimates to current funding.

j. Uncertainty Section. After the LCC has been completed, confidence intervals for each phase of the estimate should be developed using software such as Crystal Ball. This section should explain how the confidence intervals were calculated and include graphical presentations of the results.

(1) The primary inputs to the model are means and standard deviations derived from the data used in the estimate, along with the type of distribution, in most cases either a normal or triangular distribution.

(2) If, because of insufficient data, a standard deviation is borrowed from another program, it should be identified as an "analogy standard deviation". A justification for choosing that particular standard deviation should be included. Also, if a standard deviation for a particular element cannot be calculated, an average of all other elements in the phase might be used. If so, this must be noted.

(3) The results of excursions, e.g., investigating the impact of varying the learning curve, should be included in this section. In such cases there should be an explanation of why a particular value was used for the excursion.

k. Risk and Sensitivity. This section should address those assumptions, data and estimating methodologies, which are perceived to be of high risk and should evaluate the sensitivity of the cost estimates to changes in these parameters. Examples of the type of considerations in this section include:

(1) Competitive vs. sole source acquisition strategy.

(2) Volatility of labor rates.

(3) Possible growth in the size of software.

(4) Possible downscoping of the program.

(5) The impact on cost of a schedule slippage.

(6) The impact on cost of encountering technical difficulties in the program.

l. Appendices, Tabs and Attachments. As many appendices, tabs and attachments should be used as the analyst feels necessary. Highly detailed items, such as historical costs of predecessor systems used as the basis for the estimate, and complex spreadsheets for all three phases of the life cycle should be placed here. The basic sections described above should not be cluttered with this type of information. Copies of documents, such as the NPDM principals' memo, should also be placed in appendices, tabs or attachments.

3-3. Format Considerable flexibility is allowed in the presentation and format of the documentation package. The primary considerations should be completeness of information, flow of the report, ease of locating specific portions, neatness and readability. The following specifics should be included:

a. Cover Sheet. The cover sheet should include the following information relating to the estimate.

(1) ASN(FM&C) or Navy name and logo.

(2) The system for which the estimate was prepared.

(3) The ACAT.

(4) The Milestone.

(5) Names of persons and or companies who participated in the estimate; the name of the lead NCAD analyst should be first.

(6) Date of the report

(7) If business sensitive information is contained in the documentation, the cover sheet should be prominently marked to indicate this.

(8) If classified information is contained in the documentation, the cover sheet must be annotated in accordance with official security procedures.

b. Executive Summary. This should be the first page after the cover sheet and should contain the information discussed on page three.

c. Table of Contents. The table of contents should follow the executive summary and identify the major sections, appendices or attachments of the documentation package. Page numbers for locating the various sections, appendices or attachments should be included in the table of contents.

d. Sections. There should be a separate section for each area discussed under Layout, with each section beginning on a separate page. Each section may contain graphs, figures, tables, charts or tabs as necessary. These should be clearly labeled using whatever identification system the analyst wishes, e.g., Figure 1, Table 2-3, Tab A to Section 3, etc.

e. Appendices or Attachments. Appendices or attachments should be used as necessary to augment information contained in the various sections. These should be clearly labeled and included in the table of contents.

f. Page Numbering. Pages should be numbered sequentially.

g. Delineation of Subject Areas, Paragraphs and Sub-paragraphs. Delineation of major subject areas, paragraphs and sub-paragraphs within a section can be accomplished through:

(1) The use of a numbering system.

(2) The use of phrases or words to introduce topics.

(3) The use of all capitals and/or special features such as bold and underline.

(4) A combination of the above.

h. Spacing. The report should be generally single spaced, with double spacing between major sections and paragraphs. Double spacing should be used whenever it will contribute to clarity and readability.

i. Labeling and Annotation. All graphs, figures, tables, charts and spreadsheets should be clearly labeled and annotated so that no ambiguities arise as to the meaning of these displays. For example:

(1) It should always be clear whether numbers represent quantities or dollars.

(2) Every display containing cost estimates should indicate the type of dollars, e.g., FY95$M, FY96$K, TY$K, TY$M, etc.

(3) The axes on graphical presentations should be annotated to identify clearly what they represent, both qualitatively and quantitatively.

(4) It should always be clear whether cost data or estimates reflect factory costs, sell prices, flyaway costs, etc. To the extent possible, this should be annotated on displays or spreadsheets. As a minimum, there must be an explanation in the write-up.

(5) If classified information is contained in the documentation, proper annotation and handling must be followed in accordance with official security procedures.